



DEPARTMENT OF DEFENSE EXPLOSIVES SAFETY BOARD
2461 EISENHOWER AVENUE
ALEXANDRIA VIRGINIA A 22331-0600



DDESB-IK

30 JUL 2002

MEMORANDUM FOR ARMY BOARD MEMBER, COL PATRICK DUNKLE
NAVY BOARD MEMBER, CAPT MARK HELMKAMP
AIR FORCE BOARD MEMBER, COL DANIEL TOMPKINS
MARINE CORPS BOARD MEMBER, MR. JERRY MAZZA

SUBJECT: 324th Meeting of the Department of Defense Explosives Safety Board

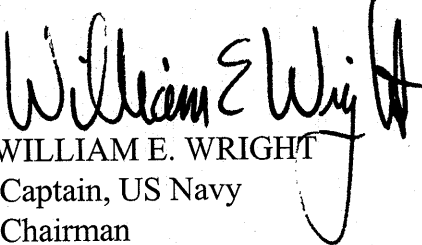
Reference: CNO Memorandum 8020 Ser N411C1/2U587677 dated 07 May 2002, Subject:
Site Approval Request for Constructing a Covered Storage Canopy at Building
915, Naval Weapons Station, Seal Beach

The Department of Defense Explosives Safety Board (DDESB) held its 324th meeting on 30 July 2002 and took the following actions:

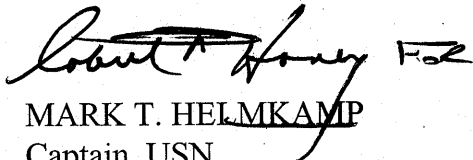
- a. The Board approved the revision of Chapter 3, DoD 6055.9-STD (attached). In addition, the Board approved incorporating the just approved revision of Chapter 3 into the DoD 6055.9-STD "Re-write" submitted for Board review.
- b. Based on the discussion of C5.5.5. "Inert Storage Area," DoD 6055.9-STD, the Service Board Members (Army, Navy, Air Force, and Marine Corps) approved the Navy request for constructing a covered storage canopy at Building 915, Naval Weapons Station, Seal Beach, CA (referenced memorandum). In addition, the Board directed the Secretariat to develop language for action at the next Board meeting to clarify application of criteria for personnel protection required by the DoD 6055.9-STD and to clarify the application of protection of inert storage areas for determination by the DoD Components.
- c. Based on the Board's recommendation, the Chairman approved the new Charter for the Risk Based Explosives Safety Criteria Team (attached).

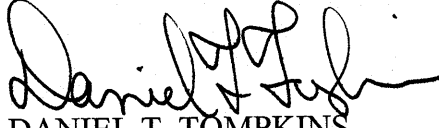



The Board scheduled the next formal meeting (325th) for 11 December 2002.


WILLIAM E. WRIGHT
Captain, US Navy
Chairman


PATRICK DUNKLE
Colonel, USA
Army Member


MARK T. HELMKAMP
Captain, USN
Navy Member


DANIEL T. TOMPKINS
Colonel, USAF
Air Force Member


JERRY MAZZA
GS-15
Marine Corps Member

Attachment
As stated

cc:

Alternate Army Board Member, Mr. James C. King
Alternate Navy Board Member, Captain Robert M. Honey
Alternate Air Force Board Member, Mr. Eric Olson
Alternate Marine Corps Board Member, Mr. Thierry Chiapello
JCS(J-4-SMPED)
DTRA (Gatski)
DCMA (DCMA-O)
TRANSCOM (TCJ4-LT)
DA, Director of Safety (Mr. J. Gibson)
USADAC/SOSAC-ES (Mr. Johnnie Cook)
NOSSA/N711 (Mr. Richard T. Adams)

APPROVED CHAPTER 3

C3. CHAPTER 3 **HAZARD CLASSIFICATION,** **STORAGE AND COMPATIBILITY PRINCIPLES,** **AND MIXING RULES**

C3.1. Hazard Classification

C3.1.1. To ease identification of hazard characteristics for storage and transportation, the DoD will use:

C3.1.1.1. DoD Ammunition and Explosives Hazard Classification Procedures as a basis for assigning hazard classifications to all AE for both storage and transportation applications. (See reference (c))

C3.1.1.2. The applicable Department of Transportation (DOT) hazardous materials regulations per 49 CFR 171 to 177. (See reference (d))

C3.1.1.3. The United Nations' (UN) international system of classification developed for the transport of dangerous goods. (See reference (e))

C3.2. DoD Hazard Classification System

C3.2.1. The DoD hazard classification system consists of nine hazard classes plus a non-regulated category that applies when explosives and hazardous materials are present in an item, but not to the degree that criteria for assignment to one of the nine classes are met. AE is assigned to the class that represents an item's predominant hazard characteristic. Class 1 applies to AE where the explosive hazard predominates. The six Class 1 divisions, and three division 1.2 sub-divisions (sub-divisions are only applicable for storage applications), which are outlined below, are used to indicate the character and predominance of explosive hazards. In addition to the classes, divisions, sub-divisions, and the non-regulated category, thirteen Compatibility Groups (CG) are used for segregating AE on the basis of similarity of function, features, and accident effects potential. Furthermore, a parenthetical number is also used to indicate the minimum separation distance (in hundreds of feet) for protection from debris, fragments, and firebrands, when distance alone is relied on for such protection. This number is placed to the left of the hazard classification designators 1.1 through 1.3 (e.g., (18)1.1, (08)1.2.3, or (02)1.3). To simply express an item's hazard classification, this Standard uses the term "Hazard Division (HD)" to avoid repeatedly using the more cumbersome terminology "Sub-division X of Division Y of Class Z". The six Class 1 divisions and three hazard sub-divisions are:

C3.2.1.1. Mass-explosion (HD 1.1).

C3.2.1.2. Non-mass explosion, fragment producing (HD 1.2). (See C9.3.2.)

C3.2.1.2.1. HD 1.2.1. Those items with a NEW for Quantity Distance (NEWQD) (See glossary) greater than 1.60 pounds (0.725 kg) or that exhibit fragmentation characteristics similar to or greater than (higher density, longer distance) M1 105 mm projectiles regardless of NEWQD.

C3.2.1.2.2. HD 1.2.2. Those items with an NEWQD less than or equal to 1.60 pounds (0.725 kg) or that at most exhibit fragmentation characteristics similar to high-explosive 40 mm ammunition regardless of NEWQD.

C3.2.1.2.3. HD 1.2.3. AE that does not exhibit any sympathetic detonation response in the stack test, or any reaction more severe than burning in the external fire test, bullet impact test, or slow cook-off test.

C3.2.1.3. Mass fire, minor blast or fragment (HD 1.3).

C3.2.1.4. Moderate fire, no significant blast or fragment (HD 1.4).

C3.2.1.5. Explosive substance, very insensitive (with mass explosion hazard) (HD 1.5).

C3.2.1.6. Explosive article, extremely insensitive (HD 1.6).

C3.2.2. Storage and Transportation Compatibility Groups (CG)

C3.2.2.1. The thirteen CG assigned to AE based on similarity of function, features, and accident effects potential are:

C3.2.2.1.1. **Group A.** Initiating explosives. Bulk initiating explosives that have the necessary sensitivity to heat, friction, or percussion to make them suitable for use as initiating elements in an explosive train. Examples include: bulk lead azide, lead styphnate, mercury fulminate, tetracene, dry cyclonite (RDX), and dry pentaerythritol tetranitrate (PETN).

C3.2.2.1.2. **Group B.** Detonators and similar initiating devices not containing two or more effective protective features. Items containing initiating explosives that are designed to initiate or continue the functioning of an explosive train. Examples include: detonators, blasting caps, small arms primers, and fuzes.

C3.2.2.1.3. **Group C.** Bulk propellants, propelling charges, and devices containing propellant with, or without, its own means of ignition. Examples include: bulk single-, double-, or triple-base, and composite propellants, rocket motors (solid propellant), and propelled AE with inert projectiles.

C3.2.2.1.4. **Group D.** Bulk black powder; bulk HE; and AE without a propelling charge, but containing HE without its own means of initiation, i.e., no initiating device is present or the device has two or more effective protective features. Examples include: bulk trinitrotoluene (TNT), Composition B, and black powder; bulk wet RDX or PETN; bombs, projectiles, cluster bomb units (CBU), depth charges, and torpedo warheads.

C3.2.2.1.5. **Group E.** AE containing HE without its own means of initiation and either containing, or with, a solid propelling charge. Examples include: artillery AE, rockets, and guided missiles.

C3.2.2.1.6. **Group F.** AE containing HE with its own means of initiation, i.e., the initiating device present has less than two effective protective features, and with or without a solid propelling charge. Examples include: grenades, sounding devices, and similar items having explosive trains with less than two effective protective features.

C3.2.2.1.7. **Group G.** Illuminating, incendiary, and smoke (including hexachlorethane (HC)) or tear-producing AE excluding those that are water-activated or that contain WP or a flammable liquid or gel. Examples include: flares, signals, and pyrotechnic substances.

C3.2.2.1.8. **Group H.** AE containing WP. AE in this group contains fillers that are spontaneously flammable when exposed to the atmosphere. Examples include: WP, and plasticized white phosphorus (PWP).

C3.2.2.1.9. **Group J.** AE containing flammable liquids or gels other than those that are spontaneously flammable when exposed to water or the atmosphere. Examples include: liquid- or gel-filled incendiary AE, fuel-air explosive (FAE) devices, and flammable liquid-fueled missiles and torpedoes.

C3.2.2.1.10. **Group K.** AE containing toxic chemical agents. AE in this group contains chemicals specifically designed for incapacitating effects more severe than lachrymation (tear-producing). Examples include: artillery or mortar AE (fuzed or unfuzed), grenades, rockets and bombs filled with a lethal or incapacitating chemical agent. (See note 4, table C3.T1).

C3.2.2.1.11. **Group L.** AE not included in other CG. AE having characteristics that present a special risk that does not permit storage with other types of AE, or other kinds of explosives, or dissimilar AE of this group. Examples include: water-activated devices, pyrophorics and phosphides and devices containing these substances, prepackaged hypergolic liquid-fueled rocket engines, triethyl aluminum (TEA), thickened TEA (TPA), and damaged or suspect AE of any group. (Note: Different types of AE in CG L presenting similar hazards may be stored together.)

C3.2.2.1.12. **Group N.** AE containing only extremely insensitive detonating substances (EIDS). An example is HD 1.6 AE.

C3.2.2.1.13. **Group S.** AE that presents no significant hazard. AE packaged or designed so that any hazardous effects from accidental functioning are limited to an extent that they do not significantly hinder firefighting. Projections should not exceed 8 J. Examples include: explosive switches or valves, and small arms ammunition.

C3.2.3. **Sensitivity Groups.** For the purpose of storage within a High Performance Magazine (HPM) or where ARMCO Revetments or substantial dividing walls are utilized, each HD 1.1 and HD 1.2 AE item is designated, based on its physical attributes, into one of five Sensitivity Groups (SG). Directed energy weapons are further identified by assigning the suffix "D" following the SG designation (e.g., SG2D). The SG assigned to an AE item is listed in the Joint Hazard Classification System (JHCS).

C3.2.3.1. The five SG, in relative order from least sensitive to most sensitive, are:

C3.2.3.1.1. SG 2: Non-robust or thin-skinned AE (See glossary).

C3.2.3.1.2. SG 1: Robust or thick-skinned AE. A SG 1 item meets any two of the following criteria:

C3.2.3.1.2.1. Ratio of explosive weight to empty case weight < 1 .

C3.2.3.1.2.2. Minimum case thickness > 0.4 inches (1 cm).

C3.2.3.1.2.3. Ratio of case thickness to $NEWQD^{1/3} > 0.05$ in/lb^{1/3}
(0.165 cm/kg^{1/3})

C3.2.3.1.3. SG 3: Fragmenting AE. These items, which are typically air-to-air missiles, have warhead cases designed for specific fragmentation (e.g., pre-formed fragment warhead, scored cases, continuous rod warheads, etc.).

C3.2.3.1.4. SG 4: Cluster bombs/dispenser munitions.

C3.2.3.1.5. SG 5: Other AE (items for which HPM non-propagation walls are not effective). Items are assigned to SG 5 because they are either very sensitive to propagation or their sensitivity has not been determined.

C3.2.3.2. Item specific testing or analyses can be used to change an item's SG.

C3.3. **Storage and Compatibility Principles**

C3.3.1. Separate storage of AE by HD and type provides the highest degree of safety. Because such storage is generally not feasible, mixed storage—subject to compliance with these Standards—is normally implemented when such storage facilitates safe operation and promotes overall storage efficiency.

C3.3.2. The CG assigned to AE indicates what it can be stored with without increasing significantly either an accident's probability or, for a given quantity, the magnitude of an accident's effects. Only compatible AE will be stored together.

C3.3.3. AE may not be stored with dissimilar substances or articles (e.g., flammable or combustible materials, acids, or corrosives) that may present additional hazards to the AE unless they have been assessed to be compatible. Non-Regulated AE and AE assigned to Classes 2 through 9 may have a CG assigned. When so assigned, the AE may be stored in an explosives magazine in accordance with the CG. The explosive weight of non-regulated AE and AE assigned to Classes 2 through 9 is not considered for quantity-distance purposes.

C3.3.4. The DoD hazard classification system classifies articles that contain riot control substances, without explosives components, and bulk toxic chemical agents as HD 6.1.

C3.3.5. AE in damaged packaging, in a suspect condition, or with characteristics that increase risk in storage, are not compatible with other AE and will be stored separately (in CG L).

C3.3.6. If different types of CG N munitions are mixed together and have not been tested to ensure non-propagation, the mixed munition types are individually considered to be HD 1.2.1 D or HD 1.2.2 D based on their NEWQD or overriding fragmentation characteristics.

C3.3.7. **High Performance Magazine.** Because of its construction (see C5.2.4), each HPM storage cell is treated as a separate magazine for the purposes of meeting compatibility and mixing requirements. Within a HPM cell, all current compatibility and mixing regulations apply. The maximum allowable NEWQD is 30,000 lbs in a HPM cell and 60,000 lbs in the loading dock with the following restraints:

C3.3.7.1. When SG 1, 2, or 3 AE is present in a HPM cell, the allowable NEWQD in all cells (adjacent, across, and diagonal) and in the loading dock remains the maximum.

C3.3.7.2. When SG 4 AE is present in a HPM cell, the allowable NEWQD in each adjacent cell and in the cell directly across from it is reduced to 15,000 lbs. The allowable NEWQD in diagonal cells and in the loading dock remains the maximum.

C3.3.7.3. When SG 5 AE is present in a HPM, the NEWQD of all cells and the loading dock must be summed for quantity-distance purposes.

C3.3.7.4. When directed energy weapons are present in a HPM, they must be oriented in such a manner that if initiation were to occur, the consequences would be directed away from any other cell. Otherwise, the NEWQD of all cells and the loading dock must be summed for quantity-distance purposes.

C3.3.7.5. When HD and SG are mixed within a HPM cell, the most sensitive SG associated with the AE in that cell controls the allowable NEWQD in each adjacent cell. For example, when HD 1.3, HD 1.4 and HD 1.6 items are stored with HD 1.1 or HD 1.2 items, the most sensitive SG of the HD 1.1 and HD 1.2 items controls the storage requirements.

C3.4. Mixed Compatibility Group Storage

C3.4.1. AE of different CG may only be mixed in storage as indicated in table C3.T1. The exceptions are when Chapter 10 is being applied, and at specific CONUS locations that a DoD Component designates to store AE packaged and configured for rapid response (e.g., Rapid Deployment Force) for which the DDESB has approved the site plan. Such designated locations are authorized to mix CG, without complying with the compatibility and mixing requirements, as operationally required to achieve the optimum load needed by the intended receiving troops. The maximum credible event allowable at any of these storage sites shall be limited to 8,820 lbs NEWQD (4,000 kg NEQ). When computing Q-D requirements for such sites, Chapter 9 applies. However, the following AE will be excluded for NEWQD determination at such storage sites:

C3.4.1.1. Propelling charges in HD 1.2 fixed, semi-fixed, mortar, and rocket AE
(See glossary).

C3.4.1.2. The NEWQD of HD 1.3 items, except at sites that contain only HD 1.3 items. At such sites, HD 1.3 Q-D applies. (Note: In the application of this paragraph to separate loading AE, the explosive weight of propelling charges are generally excluded when matched pairs of projectiles and propelling charges are at the site. However, if the quantity of propelling charges at the site exceeds the maximum usable for the quantity of projectiles at the site, the explosive weights of all propelling charges and projectiles at the site must be summed for NEWQD determination.)

Table C3.T1. Storage Compatibility Mixing Chart

CG	A	B	C	D	E	F	G	H	J	K	L	N	S
A	X	Z											
B	Z	X	Z	Z	Z	Z	Z					X	X
C		Z	X	X	X	Z	Z					X	X
D		Z	X	X	X	Z	Z					X	X
E		Z	X	X	X	Z	Z					X	X
F		Z	Z	Z	Z	X	Z					Z	X
G		Z	Z	Z	Z	Z	X					Z	X
H								X					X
J									X				X
K										Z			
L													
N		X	X	X	X	Z	Z					X	X
S		X	X	X	X	X	X	X	X			X	X

Notes:

- 1 An "X" at an intersection indicates that the groups may be combined in storage. Otherwise, mixing is either prohibited or restricted per Note 2 below.
- 2 A "Z" at an intersection indicates that when warranted by operational considerations or magazine non-availability, and when safety is not sacrificed, mixed storage of limited quantities of some items from different groups may be approved by the DoD Component. Such approval documentation must be kept on site. Component approval of mixed storage in compliance with Z intersections does not require a waiver or exemption. Mixed storage of items within groups where no X or Z exists at that pair's intersection beyond the prohibitions and limitations of note 7 below, however, requires an approved waiver or exemption.
Examples of acceptable storage combinations are:
 - a. HD 1.1A initiating explosives with HD 1.1B fuzes not containing two or more effective protective features.
 - b. HD 1.3C bulk propellants or bagged propelling charges with HD 1.3G pyrotechnic substances.
- 3 Equal numbers of separately packaged components of hazard classified complete rounds of any single type of AE may be stored together. When so stored, compatibility is that of the complete round.
- 4 CG K requires not only separate storage from other groups, but also may require separate storage within the group. The controlling DoD Component will determine which items under CG K may be stored together and those that must be stored separately. Such documentation must be kept on site.
- 5 AE classed outside Class 1 may be assigned the same CG as Class 1 AE containing similar hazard features, but where the explosive hazard predominates. Non-Class 1 AE and Class 1 AE assigned the same CG may be stored together.
- 6 DoD Components may authorize AE designated "Practice" or "Training" by nomenclature, regardless of the CG assigned, to be stored with the tactical AE it simulates. Such documentation must be kept on site.
- 7 DoD Components may authorize the mixing of CG, except items in CG A, K and L, in limited quantities generally of 1,000 lb (454 kg) total NEWQD or less. Such documentation must be kept on site.
- 8 For purposes of mixing, all AE must be packaged in its standard storage and shipping container. AE containers will not be opened for issuing items from storage locations. Outer containers may be opened in storage locations for inventorying and for magazines storing only HD 1.4 items, unpacking, inspecting, and repackaging the HD 1.4 ammunition.
- 9 When using the "Z" mixing authorized by Note 2 for articles of either CG B or CG F, each will be segregated in storage from articles of other CG by means that prevent propagation of CG B or CG F articles to articles of other CG.
- 10 If dissimilar HD 1.6N AE are mixed together and have not been tested to ensure non-propagation, the mixed AE are individually considered to be HD 1.2.1 D or HD 1.2.2 D based on their NEWQD or overriding fragmentation characteristics for purposes of transportation and storage. When mixing CG N AE with CG B through CG G or with CG S, see C9.2.1.9.1.1., C9.2.1.9.4., C9.2.1.9.10., and C9.2.1.9.11. to determine the HD for the mixture.

DOD Explosives Safety Board Risk Based Explosives Safety Criteria Working Group Charter

General

The DDESB Risk Based Criteria Working Group is established by the Chairman, Department of Defense Explosives Safety Board, and will report to that Board through the Working Group Chairman.

The Working Group Chair is authorized to establish sub-groups and assign tasks to carry out Working Group projects.

Working Group members are responsible for representing their Services on all matters addressed by the Working Group and for proposing initiatives and issues for Working Group considerations.

Objective

The objective of this Working Group is to assess and improve the overall safety associated with operations involving explosives and ammunition by providing tools, procedures, and criteria in the area of risk analysis.

Actions To Be Accomplished

Specific tasks to be performed in accomplishing the objectives of this Working Group include, but are not limited to:

- Develop a strategic plan,
- Implement an approach to meet the objectives of the strategic plan,
- Develop risk-based tools as needed,
- Document the science and assumptions used in the risk-based tools,
- Develop and provide training on risk-based tools,
- Improve the science of risk-based tools,
- Compare science of tools to tests and accident results,
- Assist the Services in performing risk-based analyses
- Develop processes and procedures for performing risk-based analyses,

- Develop criteria for risk-based analyses.

Requirements

Decision-Making. Working Group Members are responsible for representing their Service, proposing issues that affect their Service, and developing issues/proposals and other requirements as agreed on by the Working Group. The Working Group will be based on a consensus of the group. Lead members or their designee may request a vote on policy related issues from affected Services/organizations. A consensus and other dissenting opinions will be recorded in the minutes.

Membership. The following representatives have been designated as members of the DDESB Risk Based Explosives Safety Criteria Working Group:

Chairman	Mr. Eric Olson	Air Force Safety Center
DDESB Lead	Dr. Jerry Ward	DDESB Secretariat
DDESB	Dr. Josephine Covino	DDESB Secretariat
USA Lead	Mr. Ken Williams	U.S. Army Technical Center
USA	Mr. Lyn Little	U.S. Army Technical Center
USN Lead	Ms. Julie Finnegan	OPNAV (N411)
USN	Mr. Gary Hogue	NOSSA
USAF Lead	Ms. Lea Ann Cotton	Air Force Safety Center
USMC Lead	Mr. George Morrison	MARCORSYSCOM
Chair Review Panel	Mr. Eric Deschambault	DDESB Secretariat
Chair Technical Panel	Mr. Mike Swisdak	Naval Surface Warfare Center (IH)
Technical Panel	Mr. Jim Tancreto	NFESC

The Services may designate new or different representatives, subject to approval by the Chairman, DDESB

Working Group Chair. The U.S. Air Force will provide a Chairman for the Working Group. The Chairman will, at a minimum:

- Act as the focal point for all matters related to the Working Group.
- Ensure the pertinent information is disseminated to Working Group members, e.g., minutes, reference material and, technical papers.
- Coordinate and lead Working Group meetings.
- Prepare and manage a working group budget. Assign funding for support as needed.
- Provide status reports to the Board.

- Provide a Working group recommendation to the Board.
- Establish subgroups to address specific actions as needed.

Group Secretariat. APT Research, Inc. will continue to serve as the technical coordinator. In this capacity they will provide direct technical support to the chairman and members by coordinating and integrating the technical activities of the group. The group secretariat will also publish reports, papers, and presentations as required.

Meetings. The Working Group will meet at the call of the Chairman.

Invited Participants. Working Group members are encouraged to invite and utilize subject matter experts in the formulation of their Service position and in their working Group participation.

Operations And Administration

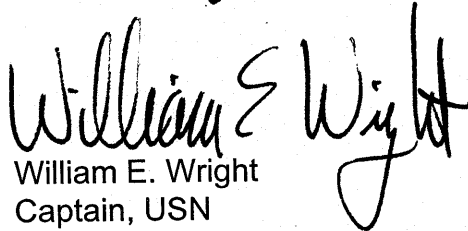
A copy of all pertinent correspondence will be provided to Chairman, DDESB and each Board Member.

Technical, administrative, and other functional support will be provided from within each of the Service organizations.

Services are responsible for travel and other funding requirements of their member associated with Working Group activities.

The DDESB Risk Based Criteria Working Group (Team) is hereby chartered. At the end of the trial period, December 2004, the Chairman, DDESB will review the charter to determine the need for any further continuation of the Working Group. If at any time a determination is made that the Working Group efforts have been completed, the Chairman, DDESB, will take action to disestablish the working group.

Charter Approval/date 30 Jul 2002



William E. Wright
Captain, USN
Chairman, DDESB